

Serial No.: 10/010,721

Examiner: A. Psitos

Title: RELIEF DIFFRACTION GRATING BODY, AND OPTICAL PICK-UP AND OPTICAL INFORMATION APPARATUS
USING THE SAME

Amendments to the Drawings:

The attached sheets of drawings include changes to Figures 1 and 2. Sheet 1, which includes Figure 2, replaces the original sheet including Figure 1. Sheet 2, which includes Figure 3, replaces the original sheet including Figure 3.

In amended Figure 2, element "d2" has been added. In amended Figure 3, element "d1" has been added.

Attachment: Replacement Sheets (2)

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REMARKS/ARGUMENTS

Reconsideration is requested in view of the following remarks. Claims 16 and 19 have been editorially revised. Claims 6, 7, 15 and 17 have been canceled. Claims 16, 18 and 19 remain pending in the application.

Objections to the Specification

The specification is objected to as introducing new matter. The specification has been editorially revised to again recite the material composition TiO₂. The objection has therefore been overcome.

Objections to the Drawings

The drawings are objected to under 37 CFR 1.83(a). The objection asserts the drawings must show every feature of the invention specified in the claims, particularly, the relationship as presented in claim 17, now canceled. Figures 2 and 3 have been amended to now depict elements "d2" and "d1", as recited in claims 16 and 19 that are editorially revised to now include the limitations of canceled claim 17. The objection has therefore been overcome.

Claim Objections

Claim 6 is objected to as not conforming with proper USPTO practice. Claim 6 has been canceled rendering this objection moot.

Claim 16 is objected to as reciting a double inclusion including a diffraction body and a diffraction means. Claim 16 has been editorially revised to recite a diffraction means provided as a separate element from the diffraction grating body. The objection has therefore been overcome.

Claim Rejections – 35 USC §112

Claims 7 and 15-19 are rejected under 35 U.S.C. §112, first paragraph. The rejection asserts previous amendments to the specification alter the disclosed invention as

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originally filed, and that pending claims, drawn to such a disclosure are not permitted. The specification has been editorially revised to its original state. The rejection has therefore been overcome.

Claims, 7 and 15-19 are rejected under 35 U.S.C. §112, second paragraph. The rejection asserts the scope of the claims is not limited to the elected species. Claim 7 has been canceled rendering this rejection moot. Claims 16 and 19 have been editorially revised to limit the configuration of the diffraction grating body to a single base material. The rejection has therefore been overcome.

Claim Rejections – 35 USC §§102/103

Claim 7 is rejected under 35 U.S.C. §102(b/e) or alternatively under 103(a) as anticipated/obvious over Tanabe et al – WO97/13245 further considered with the acknowledged prior art. Claim 7 has been canceled rendering this rejection moot.

Claim 15 is rejected under 35 U.S.C. §103(a) as anticipated/obvious over Tanabe et al – WO97/13245 further considered with the acknowledged prior art and further considered with Ramdani et al. Claim 15 has been canceled rendering this rejection moot.

Claim 17 is rejected under 35 U.S.C. §103(a) as unpatentable over the art as applied to claim 16, and further in view of Funato (US 6,072,579). Applicants respectfully traverse this rejection for the reasons given below.

Claims 16, 18 and 19 are rejected under 35 U.S.C. §103(a) as unpatentable over the art as applied to claim 7, and further in view of the acknowledged prior art. Applicants respectfully traverse this rejection.

Claims 16 and 19 each require that the photo detection portion include a photo detection portion PD0 for receiving a + first order diffracted light from the diffraction means, and a distance d1 between the center of the photo detecting portion PD0 and the

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light emitting spot of the first semiconductor laser light source and a distance d2 between the center of the photo detecting portion PD0 and the light emitting spot of the second semiconductor laser light source substantially satisfy the following relationship: $\lambda_1/\lambda_2=d_1/d_2$ (Configuration A).

Configuration A was recited in claim 17 (now canceled), for which Funato was cited.

Response to Advisory Action – Configuration A

The Advisory Action mailed March 13, 2006, asserts that the distances d1 and d2 are present in Funato. However, it is not reasonable to assume that Funato also describes the relationship between the frequency and the distance: $\lambda_1/\lambda_2=d_1/d_2$ (Configuration A). For at least these reasons, Applicants do not concede the correctness of the rejection maintained via the Advisory Action, and therefore maintain the correctness of the arguments presented herein below.

Funato describes a relationship of $L_1/d_1=L_2/d_2$ (column 16, line 45 of Funato). L1 and L2 represent wavelengths of a first light source and a second light source, respectively (column 5, lines 22-28, etc. of Funato). However, d1 and d2 represent grating pitches of a first hologram and a second hologram, respectively (column 16, lines 22-25 of Funato).

The relational expression of Funato therefore is completely different from that of Configuration A as recited in claims 16 and 19; and Funato fails to suggest the feature of Configuration A.

Further, other cited references including Tanabe, Ramdani, as well as Katsuma and Shimano, as previously cited, are also completely silent and describe nothing about Configuration A.

Response to Advisory Action – Configuration B

The Advisory Action mailed March 13, 2006, asserts that Tanabe describes that the thin film need not be present. According to the description of Tanabe however, the

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projections and recesses may be formed by providing a transparent thin film instead of directly forming projections and recesses. It is therefore the transparent thin film that need not be present, and not liquid crystal (base material). (See column 7, line 62-column 8, line 12 of Tanabe). The transparent thin film only adjusts the refractive index with liquid crystal; and liquid crystal is an essential element in the configuration of Tanabe (column 8, lines 12-18, claim 1 of Tanabe). For at least these reasons, Applicants do not concede the correctness of the rejection maintained via the Advisory Action, and therefore maintain the correctness of the arguments presented herein below that hold true regardless of the presence/absence of the transparent thin film.

Claims 16 and 19 also require that the diffraction grating is formed of a concave portion and a convex portion having rectangular shaped cross sections, and the level difference h between the concave portion and the convex portion satisfies the following relationship: $h = \lambda_1/(n_1 - 1)$ and the difference in an optical path between the concave portion and the convex portion is set to correspond to one wavelength with respect to the wavelength λ_1 (Configuration B).

Tanabe (US 6,118,586) describes a combination of a birefringent material (liquid crystal 6 in Figure 1 of Tanabe) having a different refractive index (n_0 , n_e) depending on the direction and an isotropic material (glass substrate 1 in Figure 1 of Tanabe) with convexity and concavity having a refractive index (n_1) equal to the extraordinary refractive index (n_e) of the different refractive indexes of the birefringent material (column 8, lines 47-52 of Tanabe).

With this configuration, in the case of extraordinary light for which the refractive index is n_e , the phase difference becomes 0 and no diffraction occurs since the refractive index of the birefringent material is equal to that of the isotropic material. In other words, the invention described in Tanabe does not include Configuration B recited in both claim 16 and claim 19 that requires that the difference in an optical path between the concave portion and the convex portion is set to correspond to one wavelength with respect to the wavelength λ_1 .

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For at least these reasons, claims 16 and 19 are patentable over the cited art.

Claim 18 is also patentable since it depends from claim 16. Applicants do not concede the correctness of the rejections.

Claims 7, 16, 18 and 19 are rejected under 35 U.S.C. §103(a) as obvious over Katsuma considered with the acknowledged prior art (figures 14/15) and further considered with Shimano et al. Applicants respectfully traverse this rejection for the same reasons discussed above regarding the rejection of claims 16, 18 and 19.

Further, Katsuma (US 6,084,710) as cited previously, discloses only a diffraction grating with three or more stages in the step, so that diffraction occurs greatly with respect to light with λ_2 (column 5, lines 31-36 of Katsuma).

The diffraction grating of Katsuma is based primarily on a configuration with three or more stages in the step, and is not formed of one-stage convexity and concavity, i.e., a concave portion and a convex portion having rectangular shaped cross sections, as recited in claims 16 and 19. Katsuma does not therefore describe Configuration B as recited in claims 16 and 19.

Further, other cited references including Ramdani and Shimano are completely silent and describe nothing about Configuration B.

For at least these reasons, claims 16 and 19 are patentable over the cited art. Claim 18 is also patentable since it depends from claim 16. Claim 7 has been canceled rendering this rejection moot.